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Original Research

Polyclonal outbreak of bacteremia caused by Burkholderia cepacia in the intensive care unit

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Abstract
Aim: Burkholderia cepacia is a multidrug-resistant, opportunistic pathogen of humans and outbreaks of infection in hospitals have been described. In this study, we aimed to report an outbreak in patients without cystic fibrosis or chronic granulomatous disease involving different species of Burkholderia cepacia.
Material and Methods: A small outbreak of nosocomial Burkholderia cepacia complex occurred in a 6-bed intensive care unit. We isolated Burkholderia cepacia from blood cultures of the patients admitted to our intensive care unit. All isolates from patients and the environment were identified by standard microbiological techniques and VITEK system. Antibiotic susceptibility testing was performed using Kirby Bauer's disk diffusion method and the VITEK system
Results: All isolates exhibited identical patterns of antibiotic susceptibility and all isolates were sensitive to trimethoprim-sulfamethoxazole, ceftazidime and meropenem. The isolates were typed using pulsed-field gel electrophoresis using the restriction enzymes XbaI and SpeI. Accordingly, while 4 strains were similar, one was different.
Discussion: The experience from this outbreak reminded us of the importance of outbreak investigation in such small outbreaks and keeping the health care workers educated and constant attention on this issue. The results of this study emphasized once again the necessity to maintain our sensitivity to the basic principles of sanitation and to raise our awareness of such outbreaks.

Keywords
Burkholderia cepacia, Outbreak, Intensive Care Unit

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Introduction

Burkholderia cepacia (BC) is a motile, aerobic, non-fermenting, Gram-negative bacillus, multi-drug-resistant, and more usually a colonizer [1]. Nowadays it is termed as B. cepacia complex (BCC) [2]. Outbreaks of BCC bacteremia are often associated with contaminated intravenous (IV) medications, medical devices, or skin disinfectants. Transmission of BCC by person-to-person contact, contact with contaminated surfaces, or exposure to BCC in the environment have also been reported [3-5]. In the prevention of these outbreaks, the use of personal protective equipment and hand hygiene are of maximum importance. Nosocomial infections and outbreaks are less common in intensive care units where hand hygiene compliance is high [6]. BCC species are particularly devastating pathogens for individuals suffering from chronic lung diseases such as cystic fibrosis, but in the most of the recently reported outbreaks, affected patients had no cystic fibrosis but rather had been affected by hospital-associated and immunocompromised conditions [7, 8].

In this study, we report an outbreak in patients without cystic fibrosis or chronic granulomatous disease involving different species of BCC, despite being a more predominant clone.

Material and Methods

A small outbreak of nosocomial BCC bacteremia occurred in the 6-bed intensive care unit (ICU) of a 516-bed xxxxxxx Training and Research Hospital, xxxx. In this period, Burkholderia cepacia was first isolated from the bronchial alveolar lavage and blood culture of a 72-year old patient with lung cancer. The patient did not suffer from cystic fibrosis and was treated according to bacterial sensitivity, and the bacteremia resolved after administration of the appropriate antibiotic. An outbreak investigation was done after the second case, BC were isolated from the blood cultures of four patients (total of 5 patients, mean age: 67,6 years). Four subsequent cases had both fever and other infection symptoms, and we decided that we were facing an outbreak with these findings.

Burkholderia is a waterborne and soilborne organism that can survive for a prolonged period in a moist environment. Samples were taken from the potential reservoirs like water reservoir of incubator humidifiers, heated humidifier water, respiratory devices, tap water, incubator surfaces, antiseptic products, intravenous solutions, and hygiene products (povidone, chlorhexidine and etc.). The samples were inoculated into Brain Heart Infusion broth and incubated at 37 °C for 3 days and then subcultured onto blood agar, chocolate agar and EMB agar. Although other bacteria are rarely isolated, BCC was not isolated. We performed a case-control analysis to identify risk factors, but failed to find any source. All isolates from patients and environment were identified by standard microbiological techniques and the VITEK system (VITEK 2 compact, BioMérieux, Marcy l'Etoile, France). Antibiotic susceptibility testing was done by Kirby Bauer's disk diffusion method on Muller Hinton agar, VITEK system and interpreted based on Clinical Laboratory Standard Institute (CLSI) guideline (M100, 27th edition).

The study was approved by the Ethics Committee of XXX University Medical Faculty, Turkey (40465587-154) before the study period. The research was conducted in accordance with the Declaration of Helsinki.

Results

All isolates exhibited identical patterns of antibiotic susceptibility, and all isolates were sensitive to trimethoprim-sulfamethoxazole, ceftazidime and meropenem. Although this finding suggests that all strains are similar, the isolates were typed using pulsed-field gel electrophoresis (PFGE) using the restriction enzymes XbaI and SpeI. As seen in the PFGE result, while 4 strains were similar, one was different. The distribution of molecular types based on PFGE can be seen in Figure 1. In Figure 1, the first line on the left is E. Coli ATCC 25922 strain, the second line is Burkholderia cepacia isolated from the first patient and the others patients.

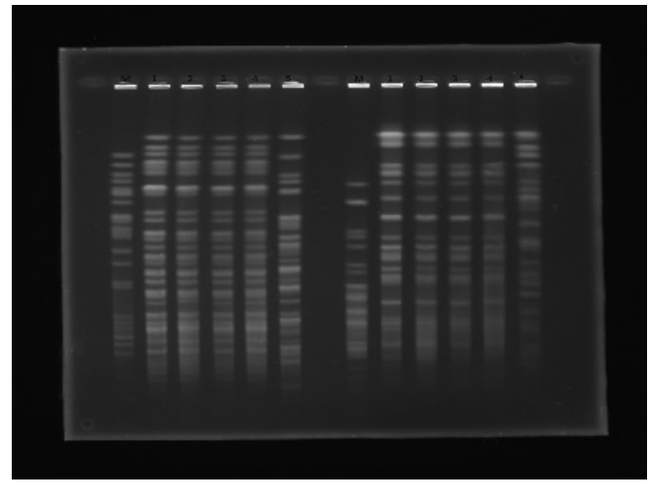

Figure 1. Pulsed-field gel electrophoresis (PFGE) using the restriction enzymes XbaI and SpeI from left to right, respectively

Discussion

In our study, it was determined that the outbreak due to BCC should be detected at first, they all show the same sequence except for one strain, the necessary precautions should be taken, the intensive care unit should be closed, and patients should be treated successfully. Although BCC is well described as a cause of respiratory infections in immunosuppressed patients (cystic fibrosis, chronic granulomatous disease such as.,), BCC bacteremia, urinary infections and nosocomial pneumonia have also been reported in intensive care units as sporadic cases or during outbreaks [9]. The non-fermentative group, in which BCC is included, ranks first in hospital infections and outbreaks [10], BCC has been linked to nosocomial outbreaks caused by contamination of medical devices, parenteral and nebulized medications, antiseptic solutions, and other environmental sources [11,12]. All ICU patients in our study underwent intubation and mechanical ventilation during their ICU stay. In order to determine the source of the BCC outbreak, samples were taken from all equipment and fluid sources, antiseptics in the intensive care unit. Unfortunately, since the outbreak is considered, cultures from the environment and potential reservoirs did not help us to find the source. The only source of happiness for us is the successful treatment of patients and the absence of new cases after the measures were taken.

While Wong et al. identified BCC with three different sequences

in an outbreak that occurred in a peritoneal dialysis unit it was determined that the source was a semi-packaging device, and environmental BCC growths should be carefully followed and included in surveillance [13]. Based on these and previous experiences, opportunistic environmental pathogens, such as BCC, Pseudomonas aeruginosa and Bacillus spp, might be used as indicator organisms for environmental contamination and included as part of routine surveillance [14]. B. cepacia is a serious threat for hospitalized patients needing invasive procedures, including the central line placement for chemotherapy, regardless of the need of any intensive care [15]. A review of the literature identified outbreaks caused by a single BCC clone, as well as outbreaks caused by different clones [4, 16, 17]. In another study, the source of BCC that caused the epidemic could not be determined for a long time, and urinary infections continued in patients despite all precautions. As a result of the four-month study, it was determined that the anesthetic gel was the source [18]. In another study, in total, 9 patients were infected with BCC. PFGE confirmed that the isolates were homologous [19]. Abdulfettah et al. isolated BCC from the blood cultures of 14 patients and from the ultrasound gel. Molecular pathogen typing using PFGE showed a 95% similarity between BCC isolates from the blood of these patients and ultrasound gel [20]. Microorganisms that are accepted as environmental contamination should be evaluated together with clinical findings in terms of whether they are a factor or a member of flora or cause contamination according to the characteristics of the region in which they reproduce [21,22]. The salient feature of this outbreak is the presence of multiple clones and unsuccessful efforts to find any source.

Conclusion:

Experience from this outbreak reminded us the importance of outbreak investigation in such small outbreaks and continuing to educate health care workers and keep a constant attention on this issue. Perhaps the most important reminder is that we need to maintain our sensitivity to the basic principles of sanitation.

In addition, since the microbiology laboratories of developing countries such as ours do not have the method of detecting microorganism sequences at the molecular level, they can establish regional equipped laboratories and follow up the epidemic more easily.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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